

PCAST Recommendations for the Physical Sciences and Engineering

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President, Georgia Institute of Technology

Engineering Research & Development Symposium
March 3, 2003

PCAST overarching concerns

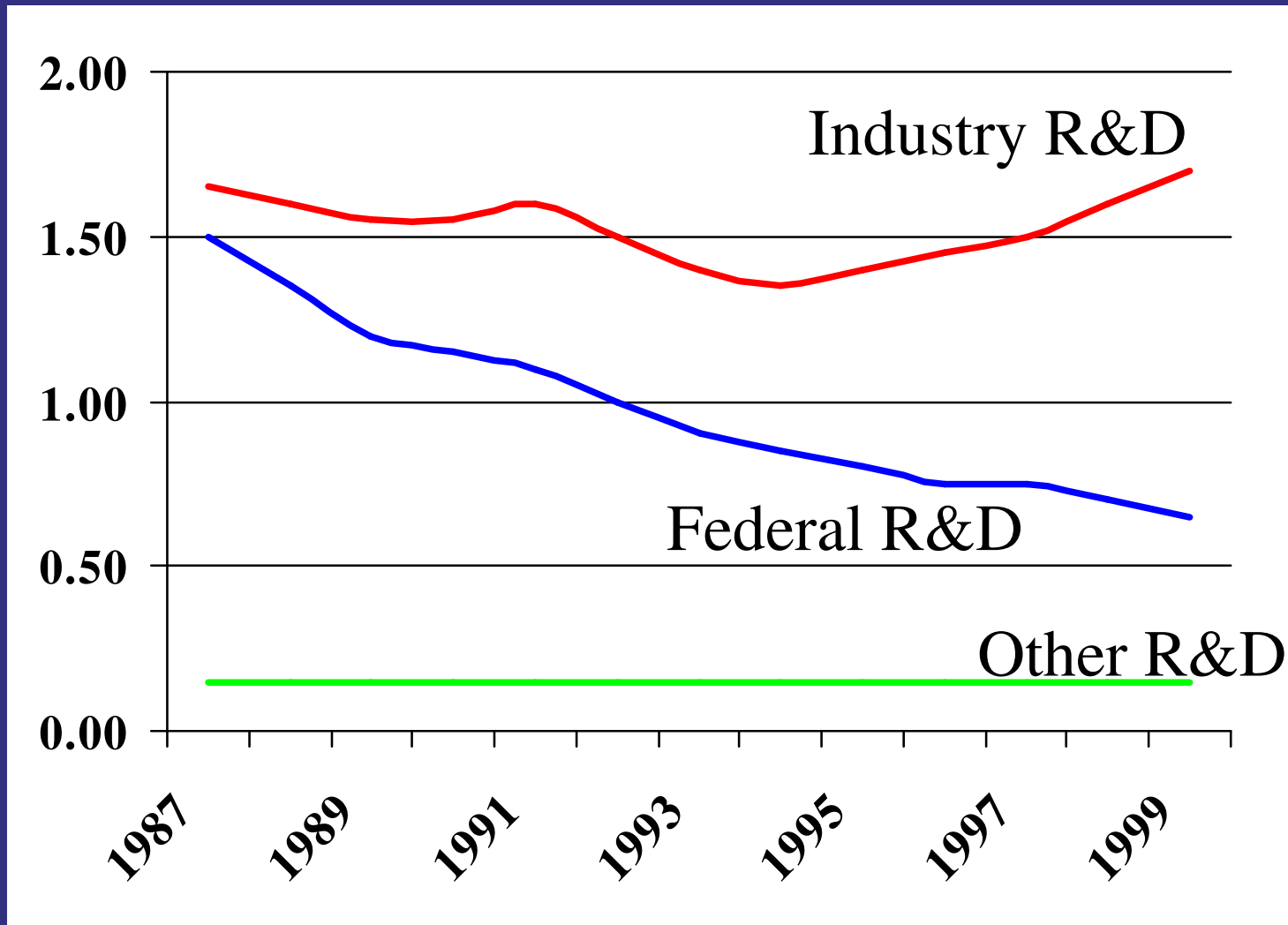
- Coordination of federal R&D portfolio to maintain appropriate distribution between areas of investments to meet national needs
- Issues related to U.S. science and engineering talent pool

PCAST process

- Hearings with federal agencies and industry associations
- RAND study reviews patterns of investments over past 24 years
- PCAST review and approval of recommendations
- Recommendation letter to PCAST Co-Chairs
- Co-Chairs' letter to President Bush

Federal and industry R&D

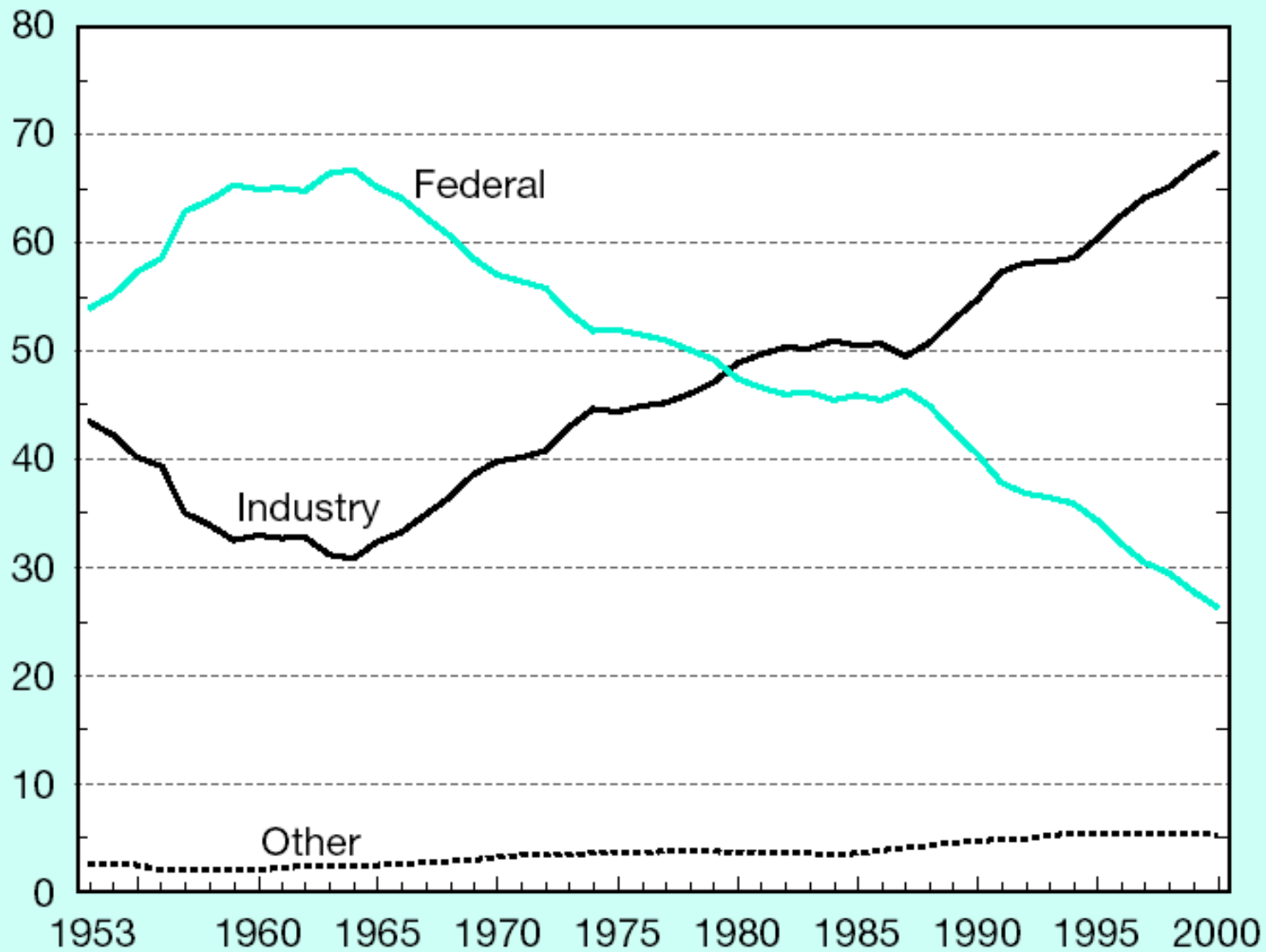
As a percentage of the Gross Domestic Product



U.S. Competitiveness 2001, Council on Competitiveness

Source of U.S. research funding

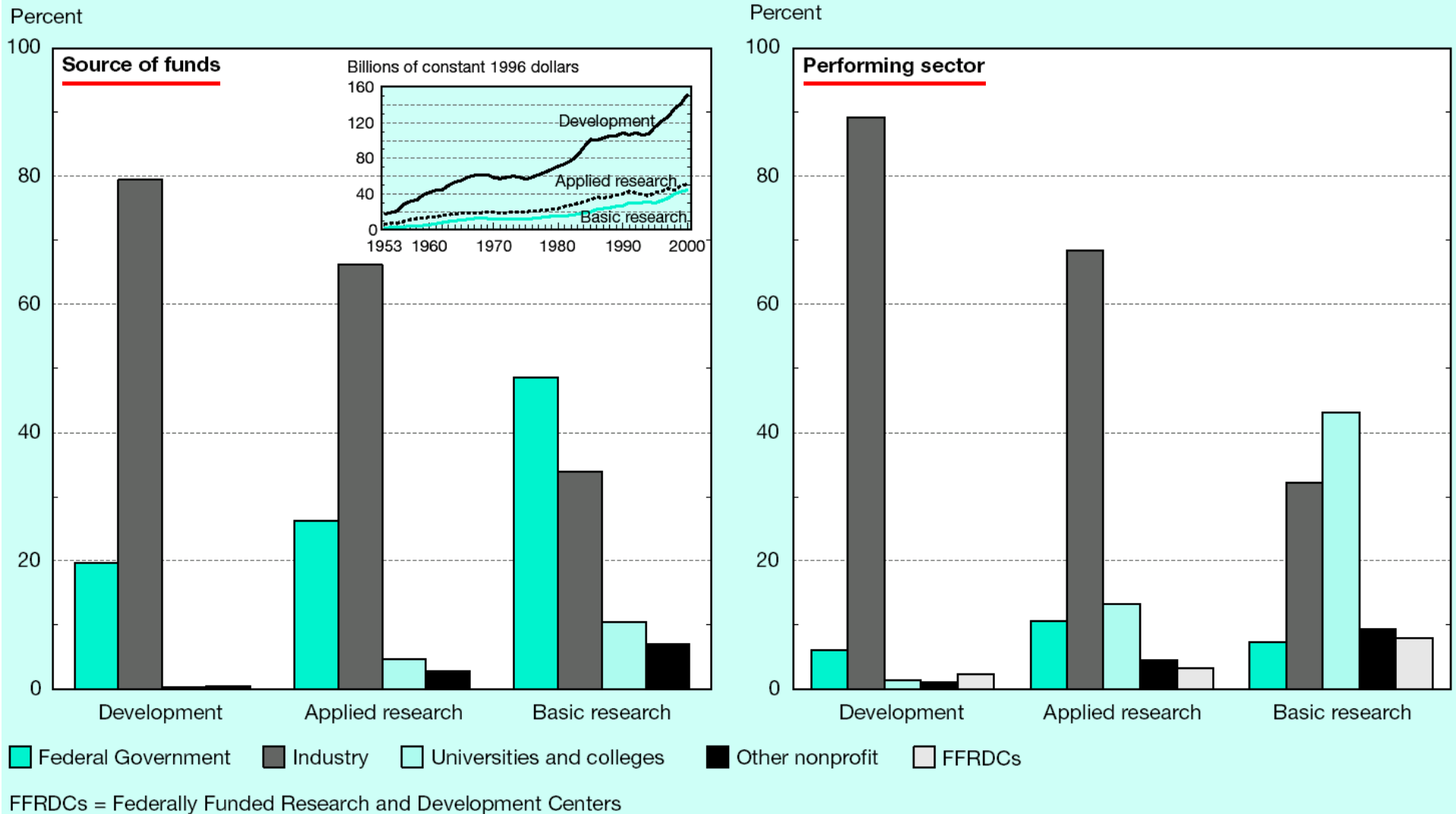
Percent of total R&D funding



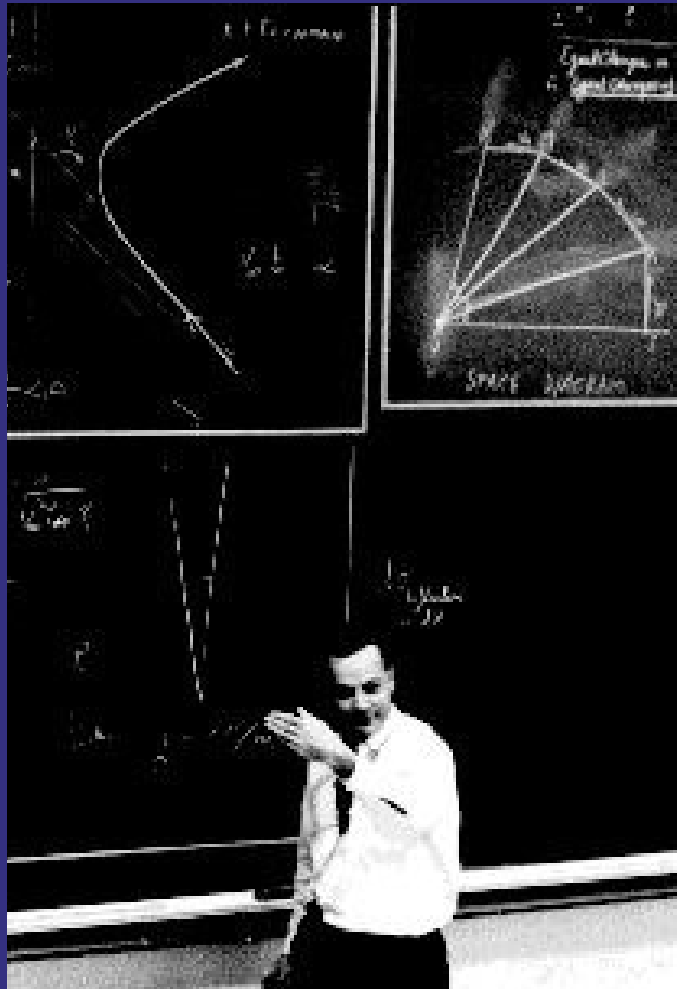
NSF Science & Engineering Indicators, 2002

National R&D: Source, performer, type

FY 2000



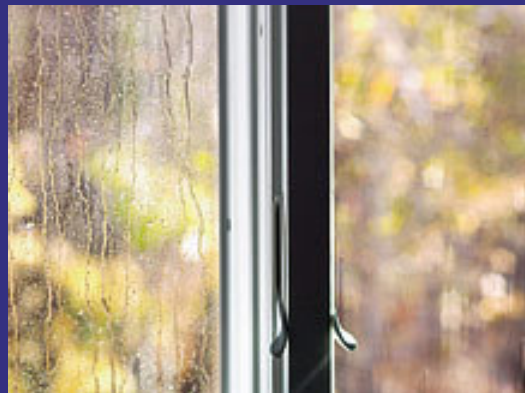
Richard Feynman



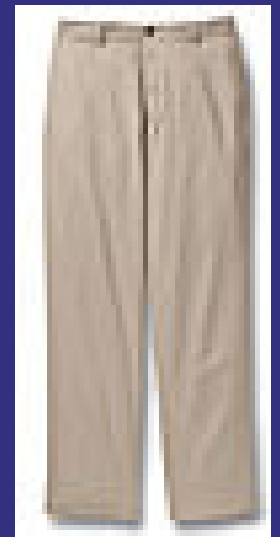
Courtesy of the Archives, California
Institute of Technology



GM Safari



PPG Industries self-
cleaning windows



Eddie Bauer
“Nano-Care” Chinos



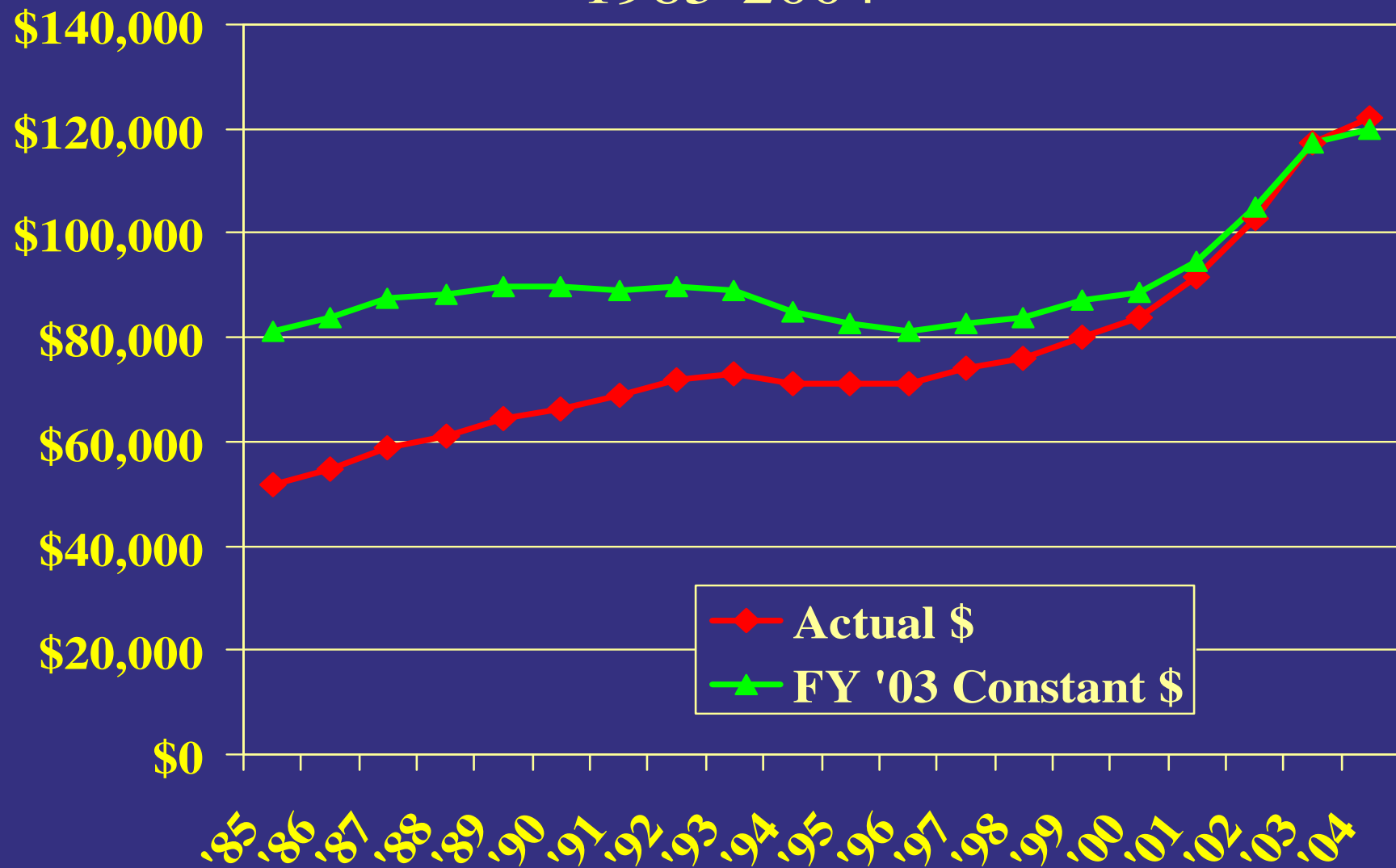
“It has proved impossible to predict reliably which areas of science will ultimately contribute to important new technologies.”

*Science, Technology and the Federal
Government: National Goals for a New Era*
COSEPUP

Federal R&D support

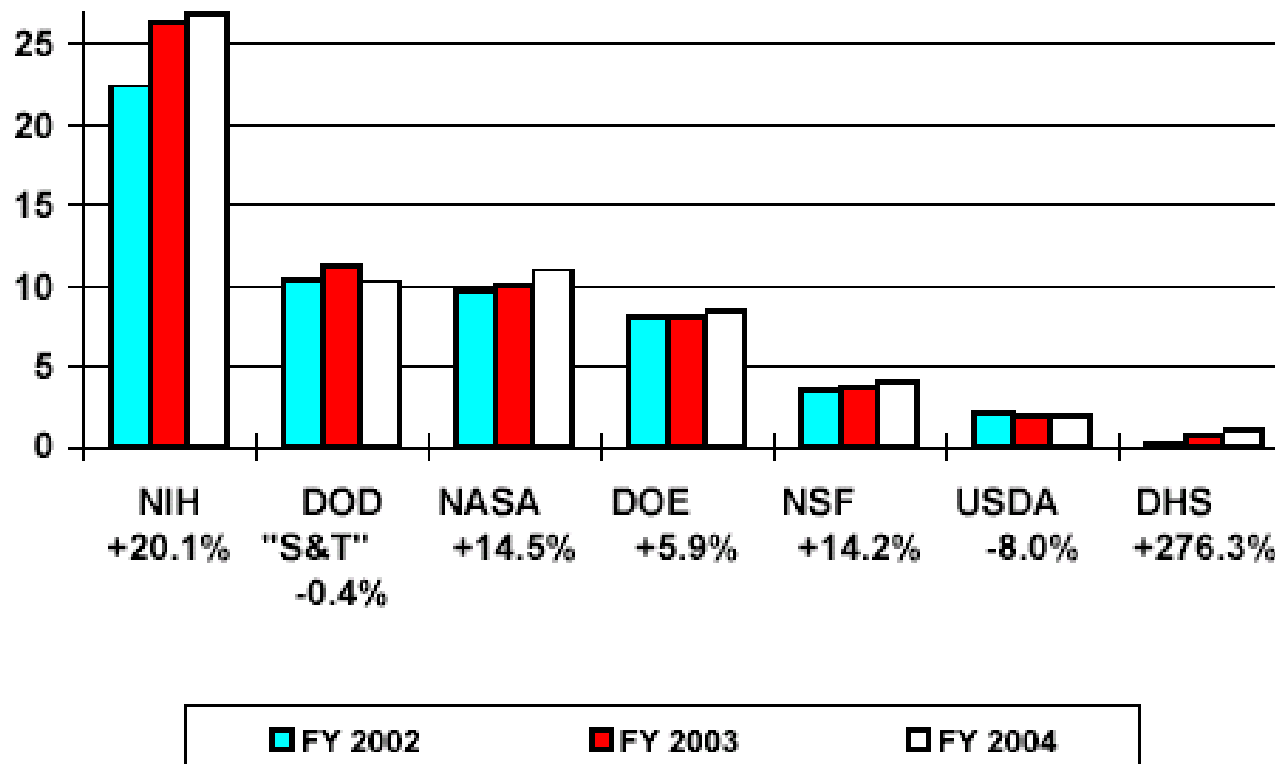
1985-2004

In millions



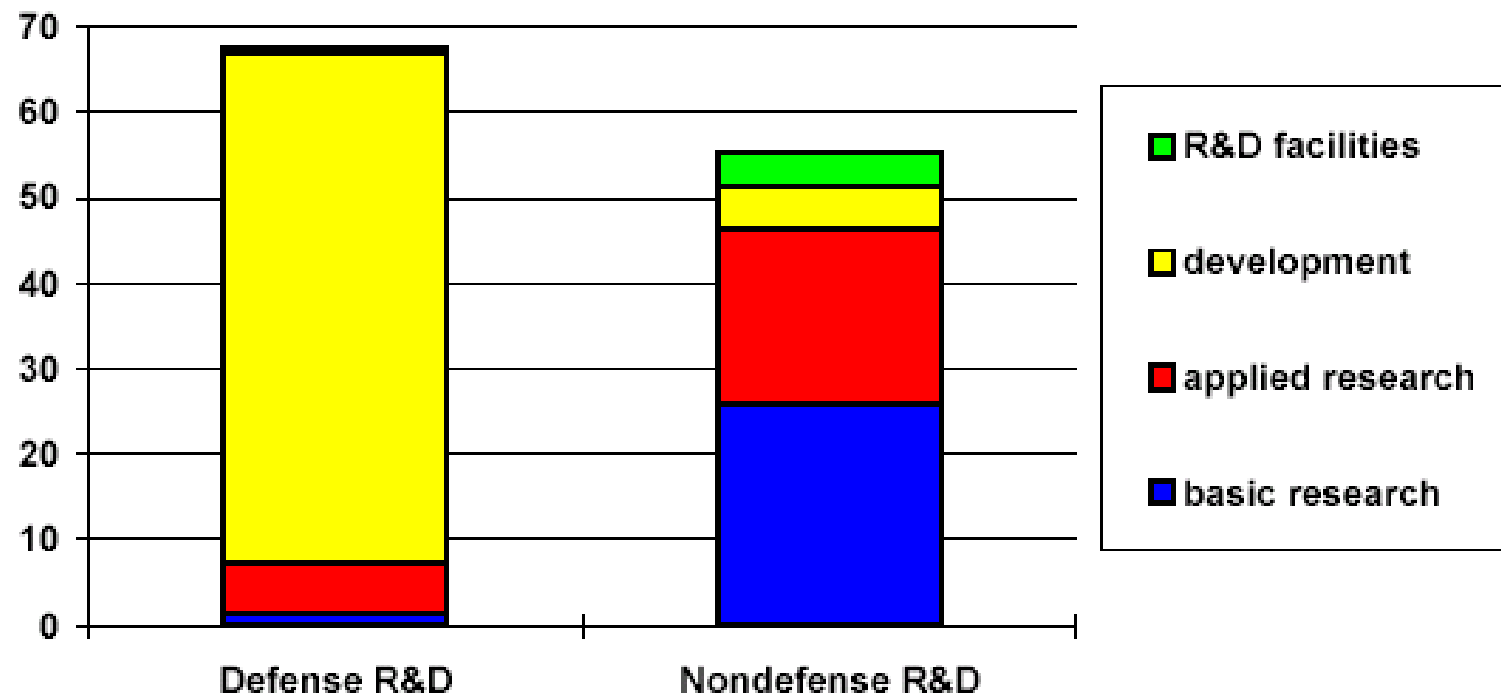
R&D in the "Big Six" Agencies + DHS, FY 2002 - FY 2004

budget authority in billions of dollars
TWO-YEAR percentage changes '02-'04



Source: AAAS, based on OMB R&D Budget Data and agency estimates for FY 2004. DOD "S&T" = DOD R&D in "6.1" through "6.3" categories plus medical research. FY 2003 = FY 2003 request except for DOD (final). FEB. '03 Preliminary © 2003 AAAS

Character of Defense and Nondefense R&D FY 2004 Budget, Budget Authority in Billions



Source: AAAS, based on OMB R&D budget data for FY 2004 and agency budget justifications. Defense R&D = DOD + DOE defense programs. FY 2004 data and FY 2003 nondefense data are President's request.

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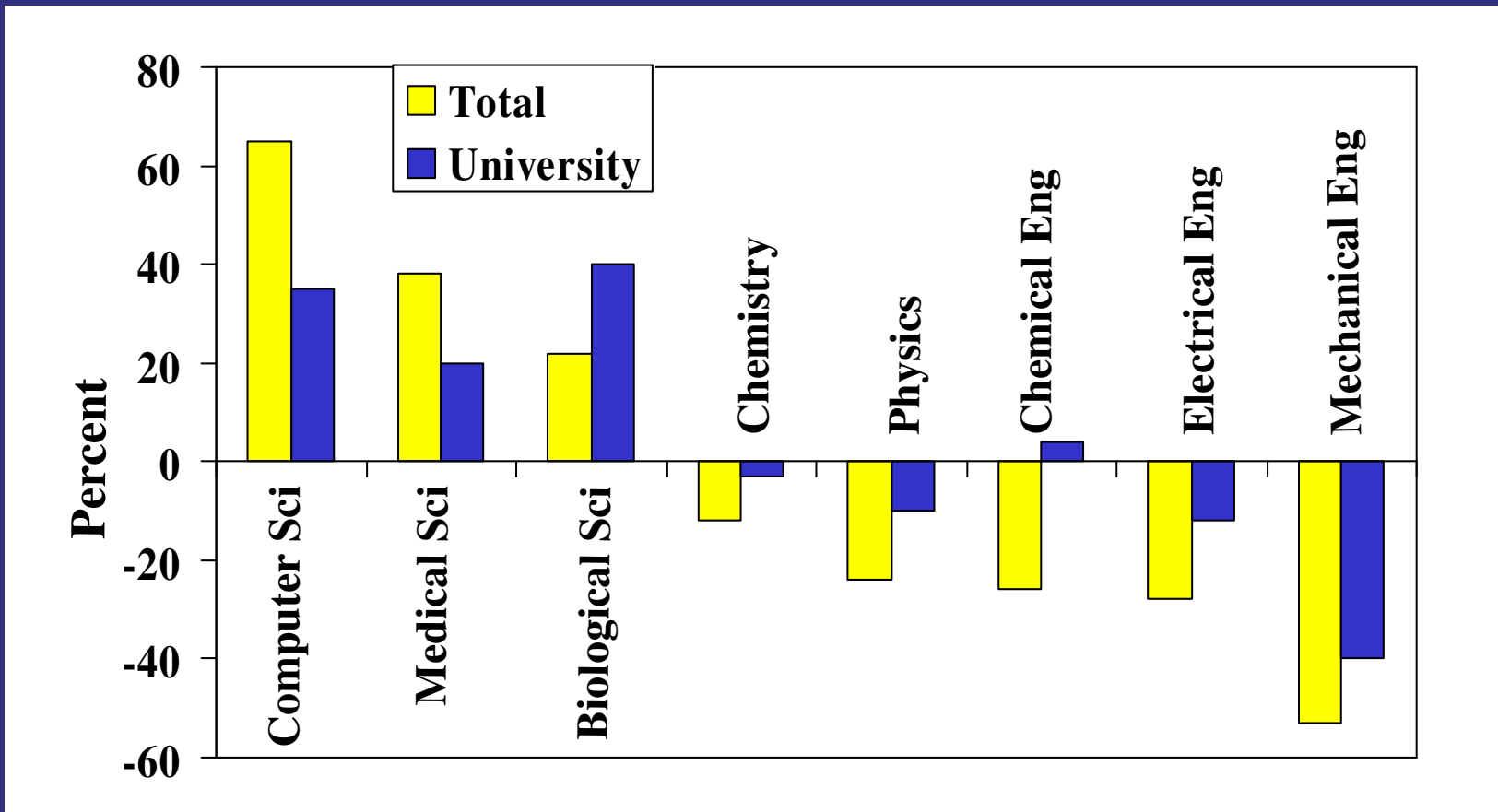


AMERICAN ASSOCIATION FOR THE
ADVANCEMENT OF SCIENCE

Areas of emphasis in President's '04 budget recommendation

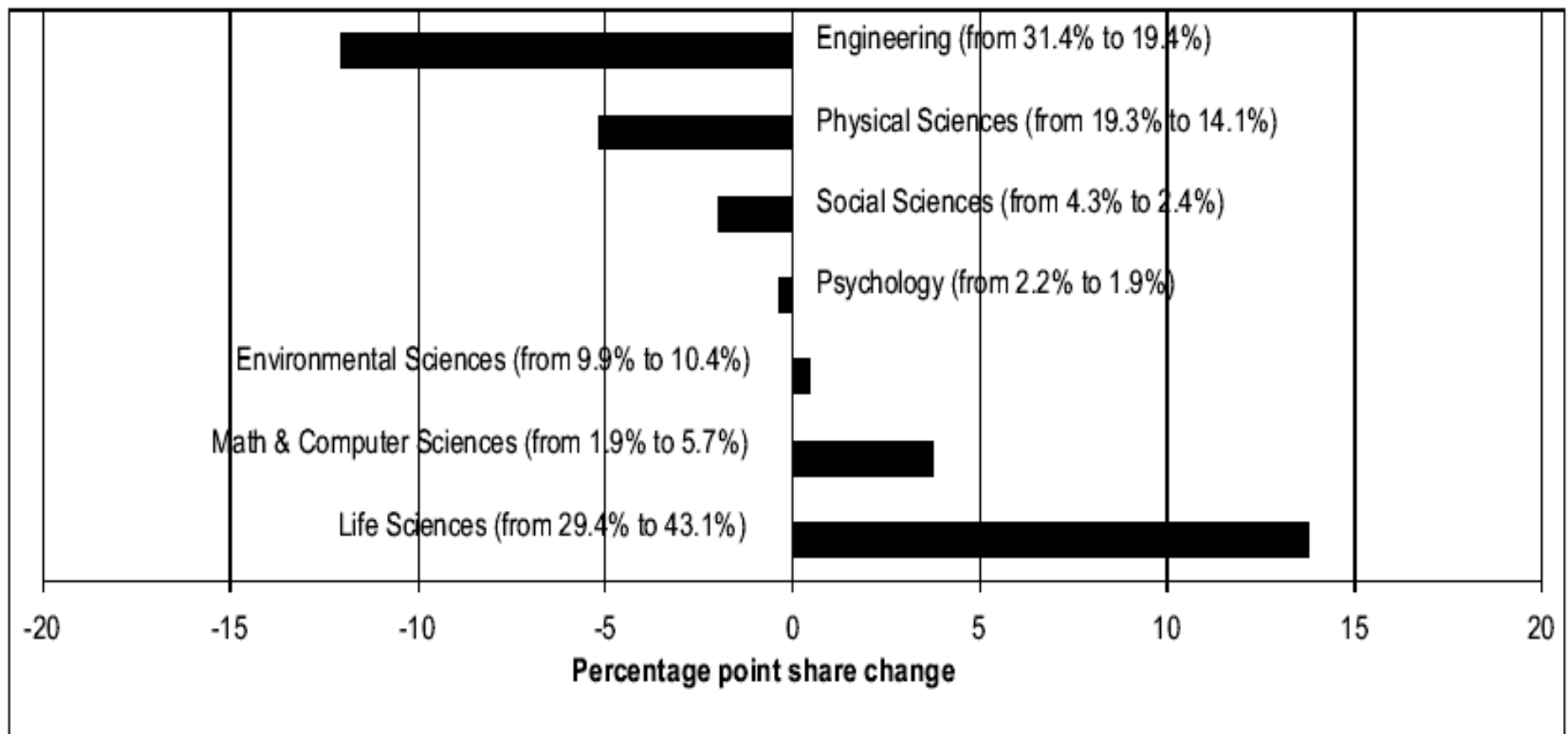
- Networking and Information Technology
- Nanotechnology Initiative
- Science and Technology to Combat Terrorism
- Physical Sciences and Engineering
- Climate Change
- K-12 Mathematics and Science Initiative
- Energy Independence – Fuel Cells

Change in federal research funding FY 1993-1999



National Research Council: *Trends in Federal Support of Research and Graduate Education*

Changes in field shares of total federal research funding (1970 – 1997)

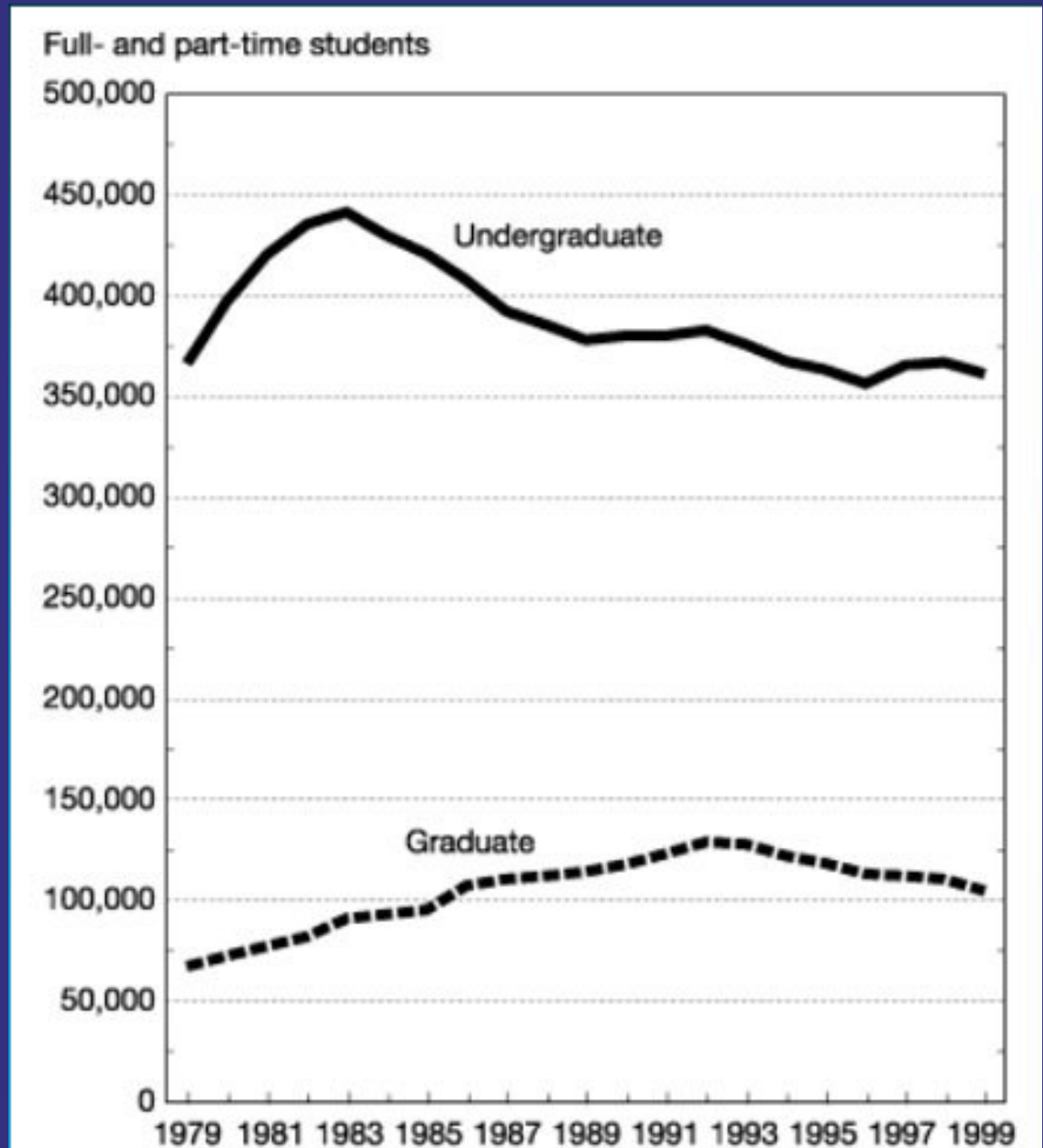


NOTE: Other sciences not classified within one of the broad fields listed above are excluded.

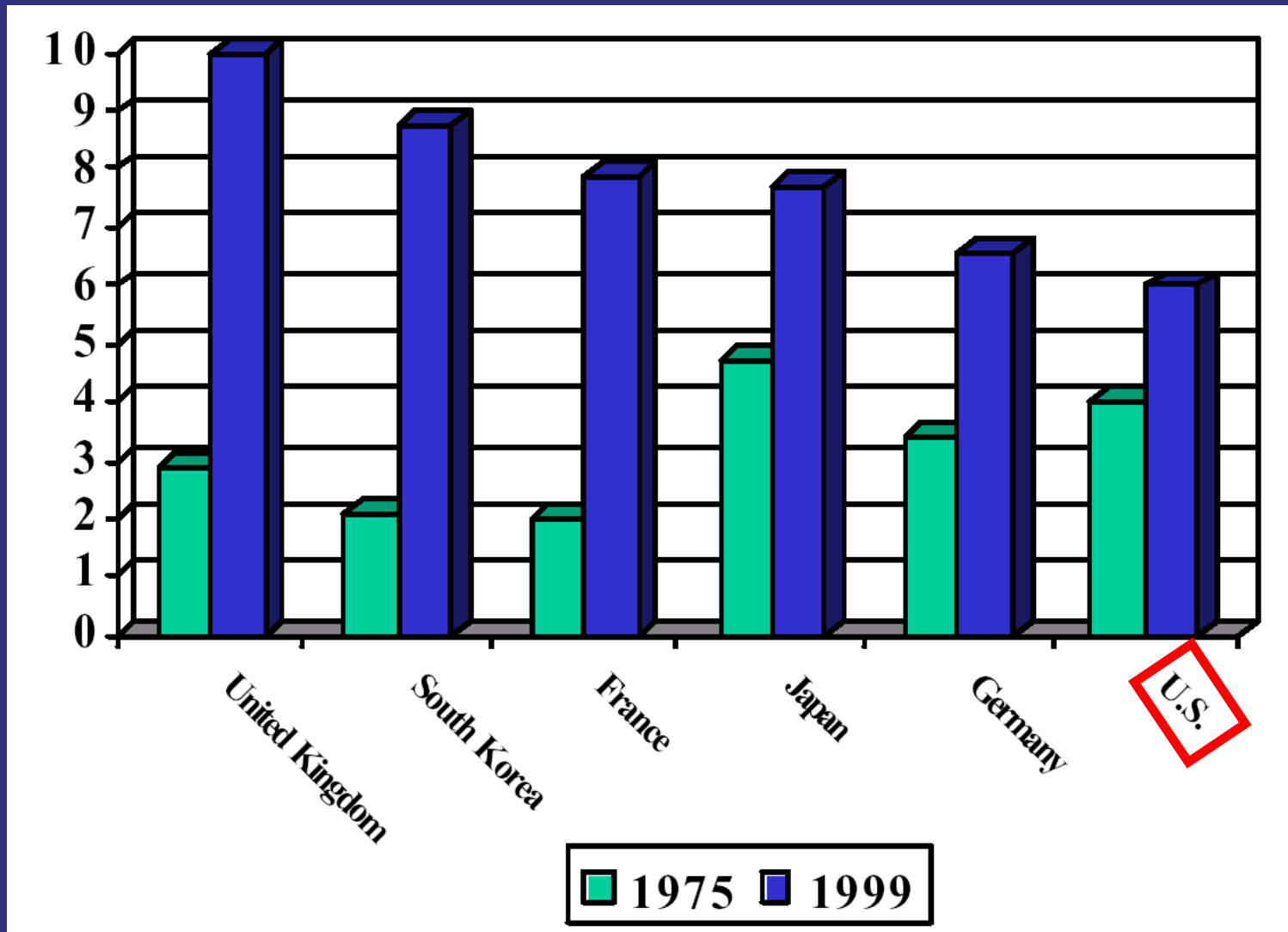
SOURCE: National Science Foundation, Division of Science Resources Studies, Survey of Federal Funds for Research and Development.

U.S. engineering enrollment

NSF Science &
Engineering Indicators
2002

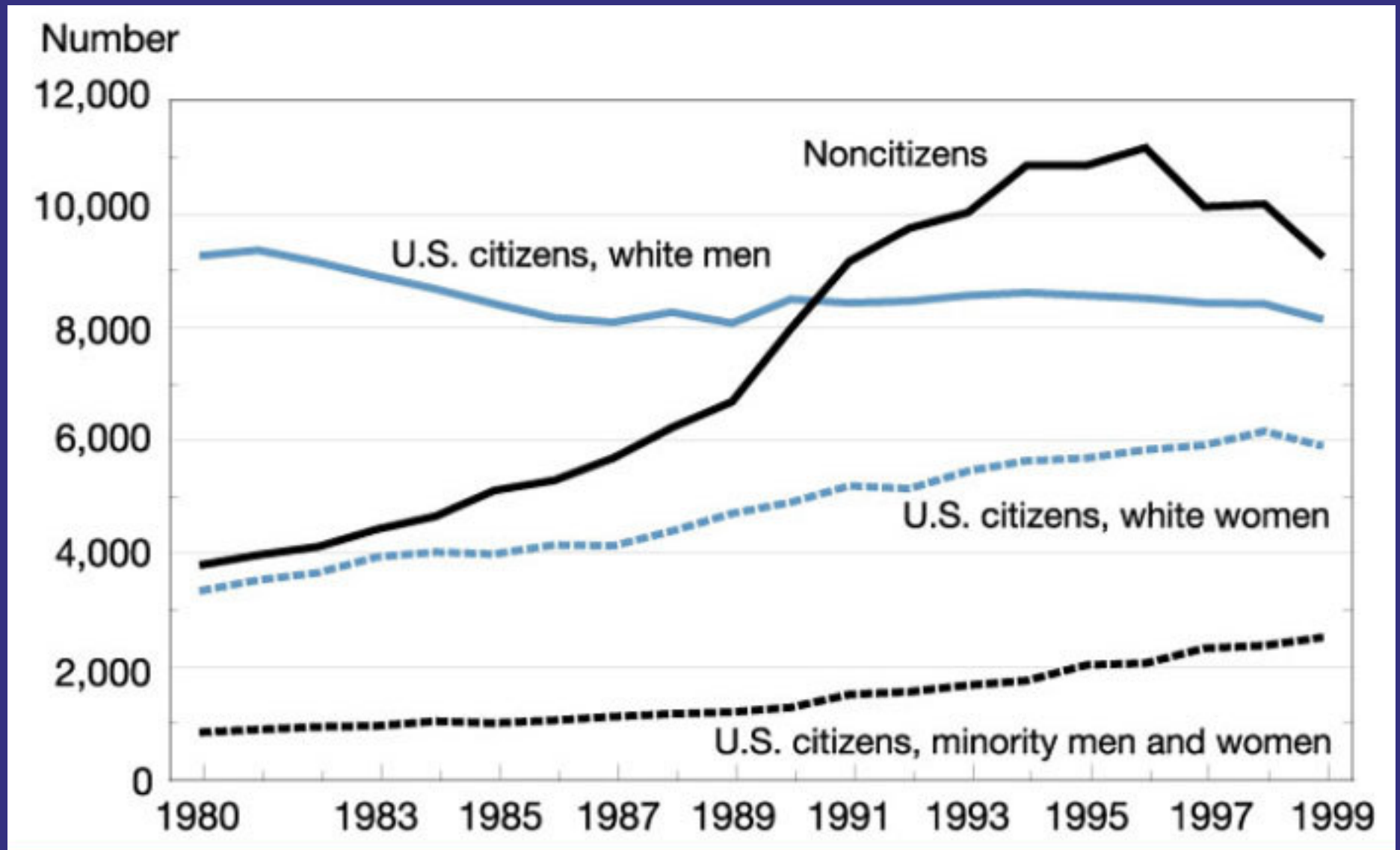


Percentage of 24-year-olds with science/engineering bachelor's degrees



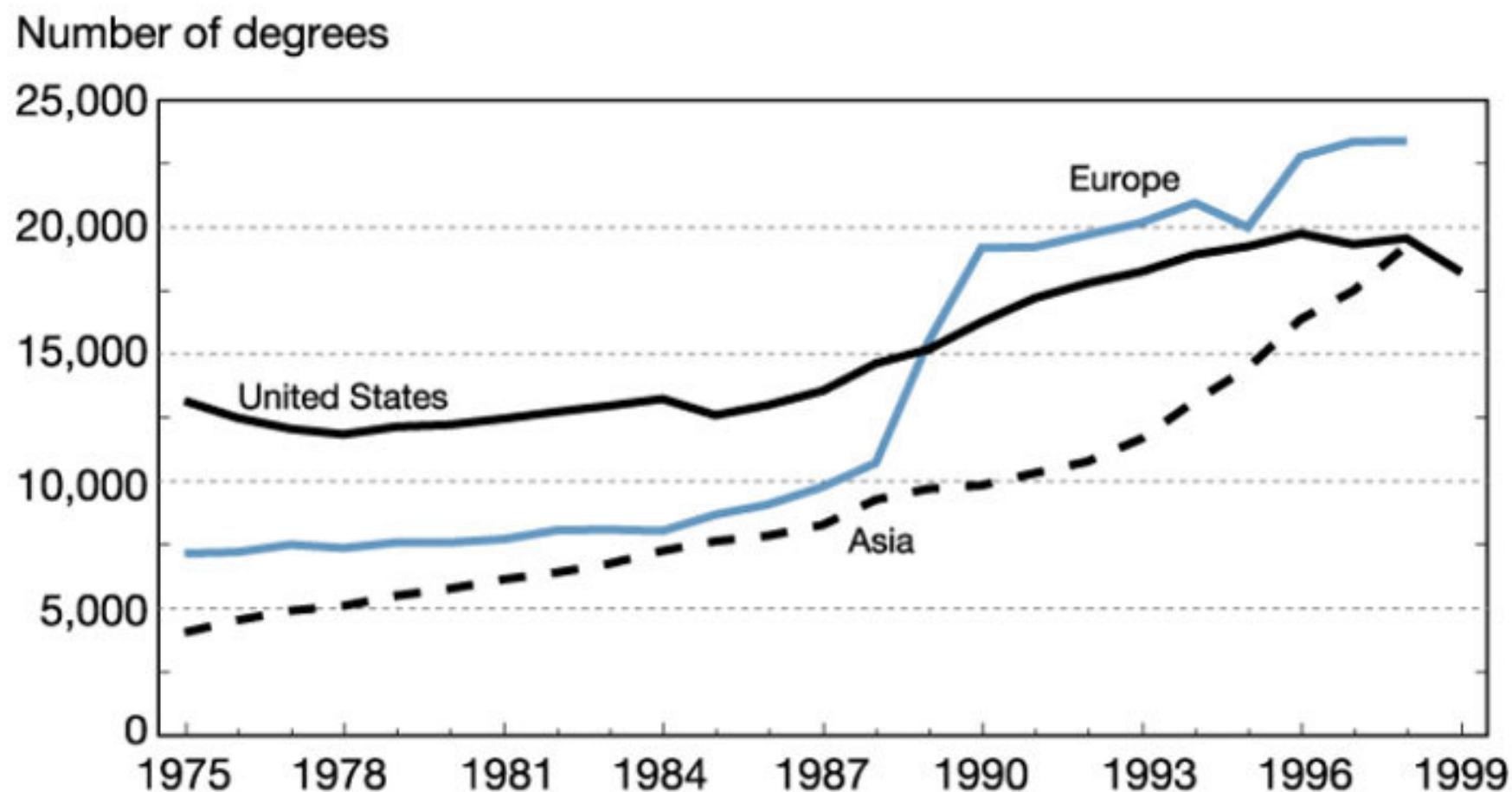
National Science Foundation

U.S. science & engineering doctorates



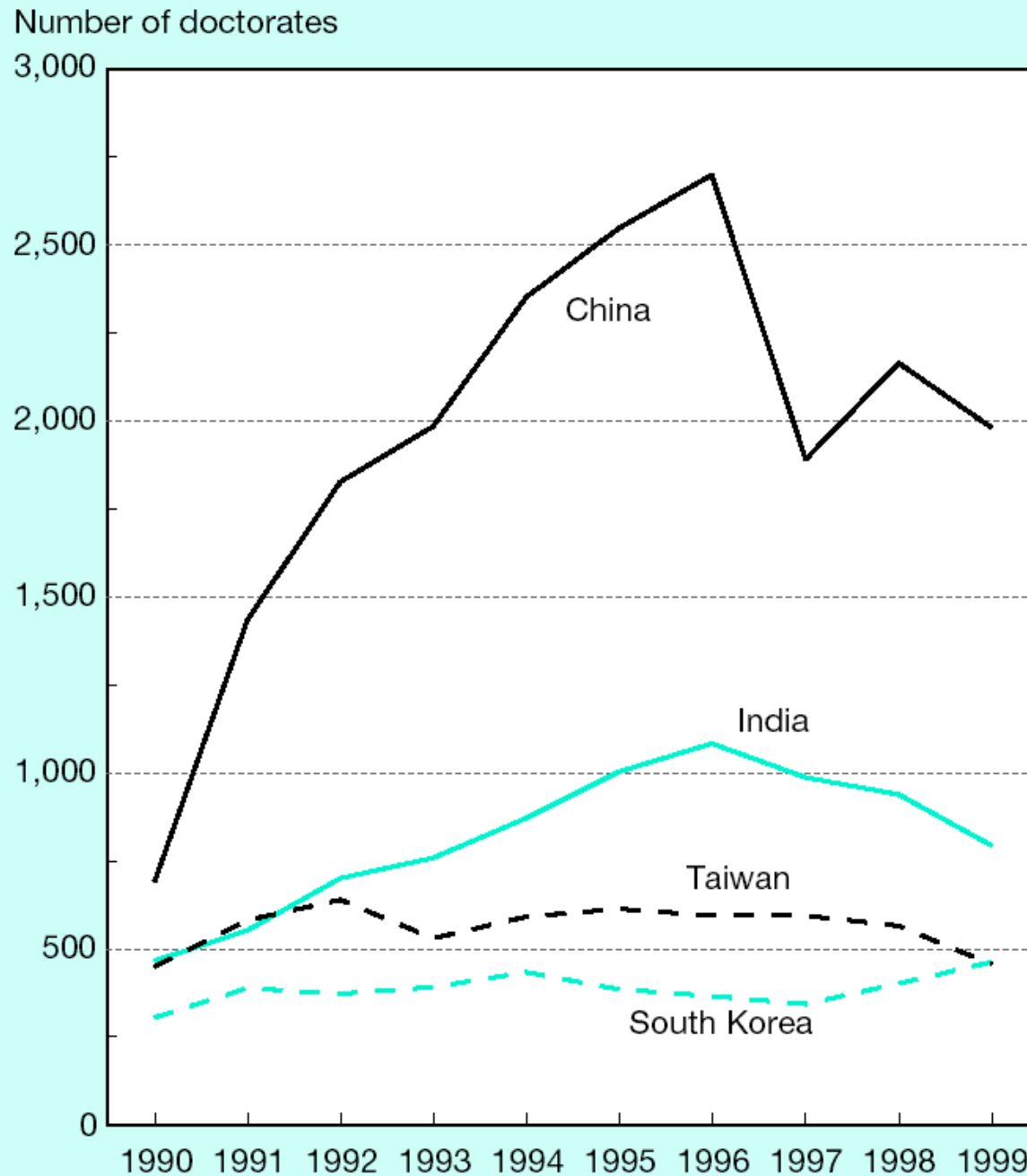
NSF Science & Engineering Indicators, 2002

Doctorates in natural sciences & engineering



NOTE: Europe includes France, Germany, and the United Kingdom. Asia includes China, India, Japan, South Korea, and Taiwan.

Doctoral students in science & engineering with plans to remain in the U.S.



NSF Science & Engineering Indicators 2002

Sleepless in Seattle

- Microsoft is investing \$400 million in facilities in India and \$750 million in China, where its research lab helped develop “digital ink” for tablet PCs.
- Boeing, which has laid off 5,000 engineers in the United States since 2001, is expanding its Moscow Design Center, which employs hundreds of Russian engineers.

“A basic business tenet is that things go to the areas where there is the best cost of production. Now you’re going to see the same trends in services that happened in manufacturing.”

Ann Livermore
Head of services at Hewlett-Packard Co,
which has 3,300 software engineers in India.

Workforce trends and issues

- Declines in U.S. undergrad and grad students in engineering and science
- Declines in international grad students in engineering and science
- High-tech companies relocating manufacturing, software and R&D facilities overseas
- Forrester Research: 3.3 million high tech jobs headed overseas by 2015
- Who will develop defense related software and hardware in the future?
- What does all of this mean to the future well being of our economy?

“Trends in federal obligations for university research directly affect graduate enrollment because research funding supports graduate research assistantships. Moreover, trends in federal obligations for university-based research also indirectly affect graduate enrollment by shaping the job market in given research fields.”

Trends in Federal Support of Research and Graduate Education
National Research Council

PCAST recommendations

- Improve funding levels for physical sciences and engineering.
- Establish a major program of fellowships to attract and support advanced U.S. graduate students in science and engineering.
- Charge the White House Office of Science and Technology Policy to assess and analyze federal R&D in the broader contexts of national interests, international competition and human resource needs.